PORTLAND CEMENT CONCRETE PAVEMENT
FIELD SECTION 502

502.1 SCOPE. To define responsibilities and establish procedures for determining and reporting thickness, surface texture and preparing a summary sheet for portland cement concrete pavement.

502.2 APPARATUS. The following apparatus and materials are necessary in addition to the requirements of any standard references in this Section:

(a) Pavement drill capable of securing nominal 5 inch (125 mm) diameter cores.

(b) Portland cement, clean concrete sand and water for mortar to patch core holes.

(c) Necessary tools for mixing mortar and patching holes.

502.3 PROCEDURE.

502.3.1 Pavement Thickness Cores. The Operations Engineer is to determine when new pavement is ready to be drilled and is to indicate the amount to be drilled. For large projects, notification should be received when about one mile (1.6 kilometers) of single-lane pavement have been placed. For projects with less than one miles (1.6 kilometers) of single-lane pavement, notification should be received when the work is completed and, if at all possible, before opening to traffic. The Operations Engineer shall assume overall responsibility for the prompt arrangement and completion of drilling operations.

502.3.1.1 The Resident Engineer is to furnish a list of all rod measurements taken at plate locations during the paving operation. After receiving this list, the Operations Engineer will be responsible for determining, marking and numbering, in numerical sequence, the locations to be drilled. Core locations shall be selected as close as possible to, without hitting, the plate at each location where the rod measurement has indicated a pavement thickness on which a deduction in payment is to be made. In addition, one randomly selected core location per 1000 feet (300 m) shall be drilled for each traffic lane of pavement constructed. Additional cores may be drilled if advisable. All random locations are the responsibility of the Operations Engineer. Where pavement is found to be over 0.2 inch (5 mm) deficient in thickness, additional cores shall be drilled at 30 foot (10 m) intervals back and ahead until pavement sufficient in thickness is encountered. In addition, where two lanes are placed at the same time, a core is to be drilled in the adjacent lane opposite each core found to be deficient in thickness and at a random distance from the centerline or lane edge. The locations for checkout cores, to determine the limits of thin pavement, shall be selected by the operator of the pavement drill or auger in accordance with these instructions and shall carry the same numerical identification as the deficient core, plus an alphabetical suffix (for example, 37A, 37B, 37C, etc.). Full depth PCCP shoulders are not normally cored unless rod measurements indicate a deficiency.

502.3.1.2 Core length measurements shall be determined according to AASHTO T148 with the following additional requirements:

(a) Measurement of broken cores will be permitted only if abrasion of the broken surfaces has not occurred, the pieces can be refitted perfectly, and the core is not deficient in thickness. Otherwise, the core must be discarded and a new core drilled.

(b) Measurement of any spalled area of any core will be permitted only if the core is not deficient in thickness. Slight adjustment of the placement of the core in the measuring device to avoid spalled areas is

permissible. If the preceding requirements cannot be met, the core shall be discarded and a new core drilled.

502.3.1.3 A record of each core length measurement, to the nearest 0.05 in. (1.25 mm) shall be entered in a Pavement Thickness Workbook.

502.3.1.4 Calculation of the average core length shall be made using the nine caliper readings obtained in accordance with paragraph 502.3.1.2 of this Section. The average reading shall be rounded and reported to the nearest 0.1 in (2.5 mm). The approved method of rounding off shall be in accordance with ASTM E29. A table to facilitate rounding-off calculations is included in the Pavement Thickness Workbook and shown as Exhibit 502-A of this Section.

502.3.1.5 Pavement Thickness Workbooks are available in Materials, Geotechnical Section, and will be provided upon request for those Districts that have modified augers capable of drilling pavement cores. Each workbook shall be numbered in a systematic, manner, e.g., a number 6-74-1 could be used with "6" referring to the District number (Headquarters Workbooks shall omit this number), "74" the year use of book was started and "1", the first book put in service for 1974. A copy of a completed page from the workbook is attached as Exhibit 502-B of this Section.

502.3.1.6 Core holes shall be patched with a mortar composed of one part portland cement and three parts clean concrete sand, by volume, mixed with just enough water to form a stiff but plastic mortar. Other approved mortar mixtures may be used. Before placing the mixture, all free water shall be removed from the bottom of the core hole. A sponge may be used for this purpose. If the hole is difficult to dry, cement may be sprinkled in the bottom. The hole shall be filled in two layers with each layer thoroughly rodded. The top layer shall be troweled to a slightly high, smooth surface. Additives such as "Sika-Set" may be used to accelerate setting time where traffic may damage patches. For such applications, the mix should be sufficiently stiff that tamping, rather than pouring, is required to fill the hole. In lieu of portland cement mixtures, one part of "Duracal" may be mixed with two parts sand and just enough water to plasticize the mixture. Approval for additives is to be obtained from the State Construction and Materials Engineer. If interference is encountered in drilling or patching operations by construction traffic, the contractor's cooperation should be obtained through the Resident Engineer.

502.3.1.7 All cores shall be identified and turned over to the Resident Engineer who is responsible for storage. Identification shall consist of an sample identification tag, which shall be filled out completely by the operator of the auger or pavement drill and wired securely to the core.

502.3.2 2AA Summary Sheet for Concrete Paving. The Resident Engineer is responsible for assuring that the 2AA work sheet is properly prepared in accordance with Sec 501.19 of the Construction Manual. Upon completion of the 2AA sheet, it will be submitted to the Operations Engineer who will be responsible for the accuracy of entries regarding materials proportions, design and other information with which he is familiar. After approval, the 2AA sheet shall be submitted to the State Construction and Materials Engineer, for processing. Prints will be made for distribution and insertion in the final plans.

502.4 REPORT.

502.4.1 Pavement Thickness Cores.

502.4.1.1 Workbooks, either completed or partially completed, shall be made available for inspection to authorized Department personnel as well as representatives of the contractor and the Federal Highway Administration if they so desire. Completed workbooks shall be turned in to Materials, Geotechnical, or, in the case of the District personnel using the modified auger, to the Operations Engineer. Work-books shall be kept on file in these respective offices for a minimum of five years.

502.4.1.2 Form T-721, Report on Cores Drilled from Concrete Pavement, shall be filled out completely in addition to the core information in the workbook. A pencil or carbon copy of each week's work shall be delivered to the Resident Engineer at the completion of the last working day of that week. This copy shall carry the notation "A Preliminary Report; a typed official copy will be issued later." The results of each week's work shall also be turned in to the Materials, Geotechnical Section, or, in the case of the District personnel, to the Operations Engineer no later than Friday of the week in which they were drilled.

(a) Under "Remarks" at the bottom of the page, in addition to such information as the occurrence of honeycomb, each sheet shall contain one of the following appropriate statements: "Coring not Completed" or "This Completes the Coring for this Project".

(b) Check out cores to determine the limits of thin pavement shall be reported at the end of the report and be so designated. In reporting the checkout cores for a particular location, the original deficient core measurement shall be repeated on the same sheet. Notations shall be made at the bottom of the check-out sheet if for some reason check-out cores were not obtained at the specified interval, 20 ft (10 m) and/or in the adjacent lane.

(c) Examples of the completed Form T-721 are attached as Exhibits 502-C and 502-D of this Section.

502.4.1.3 Form T-721 is to be distributed, accompanied by a letter of transmittal.

(a) All cores drilled by the District personnel shall be reported and the report signed by the Operations Engineer. The letter of transmittal shall be directed to the State Construction and Materials Engineer. Distribution of the report shall be as follows:

	Letter of Transmittal	Report T-711
State CO/MA Engineer	1 (original)	1
Operations Engineer	1	3

(b) All cores drilled by Materials personnel will be reported and the report signed by the State Construction and Materials Engineer. The letter of transmittal will be directed to the District Engineer. Distribution of the report shall be as follows:

	Letter of Transmittal	Report T-711
District Engineer	1 (original)	3
Operations Engineer	1	1
State CO/MA Engineer	1	1
File (Geotechnical)	1	1
File (Materials)	1	1

Average Core Length vs. Total of Nine Measurements

	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
.0 From	44.55	53.55	62.55	71.55	80.55	89.55	98.55	107.55	116.55	125.55	134.55	143.55	152.55
To	45.45	54.45	63.45	72.45	81.45	90.45	99.45	108.45	117.45	126.45	135.45	144.45	153.45
.1 From	45.50	54.50	63.50	72.50	81.50	90.50	99.50	108.50	117.50	126.50	135.50	144.50	153.50
To	46.30	55.30	64.30	73.30	82.30	91.30	100.30	109.30	118.30	127.30	136.30	145.30	154.30
.2 From	46.35	55.35	64.35	73.35	82.35	91.35	100.35	109.35	118.35	127.35	136.35	145.35	154.35
To	47.25	56.25	65.25	74.25	83.25	92.25	101.25	110.25	119.25	128.25	137.25	146.25	155.25
.3 From	47.30	56.30	65.30	74.30	83.30	92.30	101.30	110.30	119.30	128.30	137.30	146.30	155.30
To	48.10	57.10	66.10	75.10	84.10	93.10	102.10	111.10	120.10	129.10	138.10	147.10	156.10
.4 From	48.15	57.15	66.15	75.15	84.15	93.15	102.15	111.15	120.15	129.15	138.15	147.15	156.15
To	49.05	58.05	67.05	76.05	85.05	94.05	103.05	112.05	121.05	130.05	139.05	148.05	157.05
.5 From	49.10	58.10	67.10	76.10	85.10	94.10	103.10	112.10	121.10	130.10	139.10	148.10	157.10
To	49.90	58.90	67.90	76.90	85.90	94.90	103.90	112.90	121.90	130.90	139.90	148.90	157.90
.6 From	49.95	58.95	67.95	76.95	85.95	94.95	103.95	112.95	121.95	130.95	139.95	148.95	157.95
To	50.85	59.85	68.85	77.85	86.85	95.85	104.85	113.85	122.85	131.85	140.85	149.85	158.85
.7 From	50.90	59.90	68.90	77.90	86.90	95.90	104.90	113.90	122.90	131.90	140.90	149.90	158.90
To	51.70	60.70	69.70	78.70	87.70	96.70	105.70	114.70	123.70	132.70	141.70	150.70	159.70
.8 From	51.75	60.75	69.75	78.75	87.75	96.75	105.75	114.75	123.75	132.75	141.75	150.75	159.75
To	52.65	61.65	70.65	79.65	88.65	97.65	106.65	115.65	124.65	133.65	142.65	151.65	160.65
.9 From	52.70	61.70	70.70	79.70	88.70	97.70	106.70	115.70	124.70	133.70	142.70	151.70	160.70
To	53.50	62.50	71.50	80.50	89.50	98.50	107.50	116.50	125.50	134.50	143.50	152.50	161.50

TO USE TABLE:

1. Total the nine measurements and locate the sum under the proper whole number from "5." through "11.".
2. Determine the decimal that applies to the whole number under the first column.

For example: The addition of nine readings shows a total of "73.45". This sum falls under the whole number of "8." and from first column the decimal is .2. Therefore, the average length of the core is "8.2".

Exhibit 502-A

Average Core Length vs. Total of Nine Measurements

METRIC

.0 from	1131.60	1360.2	1588.80	1817.40	2046.00	2274.60	2503.20	2731.80	2960.40	3189.00	3417.60	3646.20	3874.38
to	1154.45	1383.5	1611.65	1840.25	2068.85	2297.45	2526.05	2754.65	2983.25	3211.85	3440.45	3669.05	3897.65
2.1 from	1155.70	1384.3	1612.90	1841.50	2070.10	2298.70	2527.30	2755.90	2984.50	3213.10	3441.70	3670.33	3898.90
to	1176.00	1404.60	1633.20	1861.80	2090.40	2319.00	2547.60	2776.20	3004.80	3233.40	3462.00	3690.60	3919.20
5.0 from	1177.30	1405.90	1634.50	1863.10	2091370	2320.30	2548.90	2777.50	3006.10	3234.7	.3463.30	3691.90	3920.50
to	1200.15	1428.75	1657.35	1885.95	2114.55	2343.15	2571.75	2800.35	3028.95	3257.55	3486.15	3714.75	3943.35
7.5 from	1201.40	1430.00	1658.60	1887.20	2115.80	2344.40	2573.00	2801.60	3030.20	3258.80	3487.40	3716.00	3944.60
to	1221.75	1450.35	1678.95	1907.55	2136.15	2364.75	2593.35	2821.95	3050.55	3279.15	3507.75	3736.35	3964.95
10.0 from	1223.00	943.60	1680.20	1908.80	2137.40	2366.00	2594.60	2823.20	3051.80	3280.40	3509.00	3737.60	3966.20
to	1245.90	1474.50	1703.10	1931.70	2160.30	2388.90	2617.50	2846.10	3074.70	3308.30	3531.90	3760.50	3989.10
12.5 from	1247.15	1475.70	1704.35	1932.95	2161.55	2390.15	2618.75	2847.35	3075.95	3304.55	3533.15	3761.75	3990.35
to	1267.45	1496.05	11724.65	1953.25	2181.85	2410.45	3639.05	2867.65	3096.25	324.85	3553.45	3782.05	4010.65
15.0 from	1268.75	1497.35	1725.95	1954.55	2183.15	2411.75	2640.35	2868.95	3097.55	3326.15	3554.75	3783.35	4011.95
to	1291.60	1520.20	1748.80	1977.40	2206.00	2434.60	2663.20	2891.80	3120.40	3349.00	3577.60	3806.20	4034.80
17.5 from	1292.85	1521.45	1750.05	1978.65	2207.25	2435.85	2664.45	2893.05	3121.65	3350.25	3578.85	3807.45	4036.05
to	1313.20	1541.80	1770.40	1999.00	2227.60	2456.20	2684.80	2913.40	3142.00	3370.60	3599.20	3827.80	4056.40
20.0 from	1314.45	1543.05	1771.65	2000.25	2228.85	2457.45	2686.06	2914.65	3143.25	3371.85	3600.45	3829.05	4057.65
to	1337.30	1565.91	1794.50	2023.10	2251.70	2480.30	2708.90	2937.50	3166.10	3394.70	3623.30	3851.90	4080.50
22.5 from	1338.60	1567.20	1795.80	2024.40	2253.00	2481.60	2710.20	2938.80	3167.40	3396.00	3624.60	3853.20	4081.80
to	1358.90	1587.50	1816.10	2044.70	2273.30	2501.90	2730.50	2959.10	3187.70	3416.30	3644.90	3873.50	4102.10

TO USE THIS TABLE:

1. Total the nine measurements and locate the sum under the proper whole number from "125" through "425".

2. Determine the decimal that applies to the whole number under the first column.

For example: The addition of nine readings shows a total of "1863.10". This sum falls under the whole number of "200" and from the first column the decimal is 5.0. Therefore, the average length of the core is "205.0".

EXHIBIT 502-A METRIC

PAVEMENT CORE MEASUREMENTS

RTE. _____CTY _____PROJECT _____

DATE _____OPERATOR _____ TYPE OF PAVEMENT _____

Thickness (inches) Measure to nearest .05 inch

IDENT NO.	23.00	22.00	21.00	20.00	19.00	18.00	17.00	16.00	14.00	13.00	12.00
Reading No. 1	8.00	8.10	8.00	8.20	7.70	8.40	7.80	7.80	8.30	8.20	8.20
Reading No. 2	8.00	8.10	8.00	8.20	7.70	8.40	7.80	7.80	8.30	8.20	8.20
Reading No. 3	8.00	8.20	7.90	8.20	7.75	8.40	7.85	7.85	8.30	8.20	8.20
Reading No. 4	8.00	8.20	7.90	8.20	7.75	8.40	7.85	7.85	8.30	8.20	8.20
Reading No. 5	8.00	8.20	7.90	8.20	7.80	8.40	7.90	7.80	8.30	8.20	8.20
Reading No. 6	8.00	8.10	7.90	8.20	7.80	8.40	7.80	7.85	8.30	8.20	8.20
Reading No. 7	8.00	8.10	7.90	8.20	7.75	8.40	7.80	7.80	8.30	8.20	8.20
Reading No. 8	8.00	8.20	8.00	8.20	7.75	8.40	7.80	7.80	8.30	8.20	8.20
Reading No. 9	8.00	8.20	8.00	8.20	7.75	8.40	7.80	7.80	8.30	8.20	82.20
Total	72.01	73.40	71.50	73.80	69.75	75.60	70.40	70.35	74.70	73.80	73.808.2
Average*(Total/9)	8.00	8.20	7.90	8.20	7.80	8.40	7.80	7.80	8.30	8.20	8.20

Thickness (inches) Measure to nearest .05 inch

IDENT NO.	11	10	8	9	15	15H	15B	15C	24	25	
Reading No. 1	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.75	8.00	
Reading No. 2	8.20	8.60	8.30	7.90	7.60	7.90	8.20	8.60	7.75	8.00	
Reading No. 3	8.20	8.60	8.30	7.90	7.60	7.85	8.20	8.60	7.75	7.90	
Reading No. 4	8.20	8.60	8.30	7.90	7.60	7.85	8.20	8.60	7.80	7.90	
Reading No. 5	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.80	7.90	
Reading No. 6	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.75	7.90	
Reading No. 7	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.75	7.90	
Reading No. 8	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.70	8.00	
Reading No. 9	8.20	8.60	8.30	7.90	7.60	7.85	8.20	8.60	7.70	8.00	
Total	73.80	77.40	74.70	71.10	68.40	70.45	73.80	77.40	69.75	71.50	
Average*(Total/9)	8.20	8.60	8.30	7.90	7.60	7.80	8.20	8.60	7.80	7.90	

NOTE: *Record to nearest 0.1 inch.

REMARKS:

Exhibit 502-B

Pavement Core Measurements

METRIC

Rte. 201 COUNTY Winston PROJECT F-201-1(30
DATE 12/23-24/96 OPERATOR Bill Sharp TYPE OF PAVEMENT 200 mm Reinf.

Thickness (mm) Measure to nearest 1.25 mm

Ident No. 23	23	22	21	20	19	18	17	16	14	13	12
ReadingNo.1	203.20	208.75	203.20	208.30	195.60	213.40	198.10	198.10	210.80	208.30	208.30
ReadingNo.2	203.20	205.75	203.20	208.30	195.60	213.40	198.10	198.10	210.80	208.30	208.30
ReadingNo.3	203.20	208.30	200.65	208.30	195.85	213.40	199.40	199.40	210.80	208.30	208.30
ReadingNo.4	203.20	208.30	200.65	208.30	196.85	213.40	199.40	199.40	210.80	208.30	208.30
ReadingNo.5	203.20	208.30	200.65	208.30	198.10	213.40	200.65	198.10	210.80	208.30	208.30
ReadingNo.6	203.20	205.75	200.65	208.30	198.10	213.40	198.10	199.40	210.80	208.30	208.30
ReadingNo.7	203.20	205.75	200.65	208.30	196.85	213.40	198.10	198.10	210.80	208.30	208.30
ReadingNo.8	203.20	208.30	203.20	208.30	196.85	213.40	198.10	198.10	210.80	208.30	208.30
ReadingNo.9	203.20	208.30	203.20	208.30	196.85	213.40	198.10	198.10	210.80	208.30	208.30
Total	1828.80	1864.35	1816.10	1874.50	1771.65	1920.25	1788.15	1786.90	1897.40	1874.50	1874.50
Average	206.20	207.15	201.80	208.30	196.85	213.35	198.70	198.55	210.80	208.30	208.30

(Total /9)

Thickness (mm) Measure to nearest 1.25 mm

Ident No.	11	10	8	9	15	15H	15B	15C	24	25	
ReadingNo.1	208.30	218.45	210.80	200.65	193.05	198.10	208.30	218.45	196.85	203.20	
ReadingNo.2	208.30	218.45	210.80	200.65	193.05	200.65	208.30	218.45	196.85	203.20	
ReadingNo.3	208.30	218.45	210.80	200.65	193.05	199.40	208.30	218.45	196.85	200.65	
ReadingNo.4	208.30	218.45	210.80	200.65	193.05	199.40	208.30	218.45	196.85	200.65	
ReadingNo.5	208.30	218.45	210.80	200.65	193.05	198.10	208.30	218.45	198.10	200.65	
ReadingNo.6	208.30	218.45	210.80	200.65	193.05	198.10	208.30	218.45	196.85	200.65	
ReadingNo.7	208.30	218.45	210.80	200.65	193.05	198.10	208.30	218.45	195.60	203.65	
ReadingNo.8	208.30	218.45	210.80	200.65	193.05	198.10	208.30	218.45	195.60	203.20	
ReadingNo.9	208.30	218.45	210.80	200.65	193.05	199.40	208.30	218.45	195.60	203.20	
Total	1874.50	1965.95	1897.40	1805.95	1737.35	1789.45	1874.50	1771.65	1771.65	1816.10	
Average	208.30	218.45	210.80	200.65	193.05	198.80	208.30	218.45	196.85	201.80	

(Total/9)

NOTE: *Record to nearest 2.50 mm

Remarks:

EXHIBIT 502-B METRIC

Form T-721
Rev.3-85

MISSOURI DEPARTMENT OF TRANSPORTATION
MATERIALS

PAVEMENT THICKNESS CORE REPORT

PAGE 1 OF 4

PROJ F-201-2(3) RTE. 201 CO. Winston

CONTRACTOR XYZ Construction R.E. Robert McCatkill

DRILLER Bill Sharp WORKBOOK #84-7 DATE DRILLED 12/23-24/84

TYPE OF PAVEMENT 8" Reinforced LOCATION REFERENCED TO: Centerline

IDENT NO.	LANE OR RAMP	STATION	LOCATION	MEASUREMENTS PLATE	CORE	MESH DEPTH	DATE POURED
8	W.B.L.	478+50	4' Rt.		8.30	3 1/2"	10-25-84
9	W.B.L.	481+00	9' Lt.	7.90	7.90	3 1/8"	"'
10	W.B.L.	483+60	6' Rt.		8.60	3"	"
11	W.B.L.	486+10	3' Lt.		8.20	3 1/4"	"
12	W.B.L.	488+70	8' Rt.		8.20	4 1/8"	"
13	W.B.L.	491+20	4' Lt.		8.20	3 1/2"	10-26-84
14	W.B.L.	495+80	9' Rt.		8.30	3 5/8"	"
*15	W.B.L.	498+26	6' Lt.		7.60	3 1/2"	10-29-84
16	W.B.L.	501+01	3' Rt.		7.80	3 1/4"	"
17	W.B.L.	504+00	5' Lt.	7.80	7.80	3"	"
18	W.B.L.	506+50	9' Rt.		8.40	3 1/2"	"
19	W.B.L.	508+00	5' Lt.	8.00	7.80	3 1/2"	10-30-84
20	W.B.L.	510+90	9 Rt.		8.20	3 1/2"	"
21	W.B.L.	513+40	6' Lt.		7.90	3 1/4"	"
22	W.B.L.	516+00	4' Rt.		8.20	3 1/4"	11-16-84
23	W.B.L.	518+50	7' Lt.		8.00	3 1/2"	"
24	W.B.L.	521+30	3' Rt.		7.80	3 1/2"	"
25	W.B.L.	523+60	4' Lt.		7.90	3 1/4"	"

Remarks:
* Short Core
Ident. No. 22 Honeycomb
Coring Not Completed.

/S/ State Construction and Materials Engineer

Exhibit 502-C

Form T-721
Rev.3-85

MISSOURI DEPARTMENT OF TRANSPORTATION
MATERIALS

PAVEMENT THICKNESS CORE REPORT

PAGE 4 OF 4

PROJ F-201-2(3) RTE. 201 CO. Winston

CONTRACTOR XYZ Construction R.E. Robert McCatkill

DRILLER Bill Sharp WORKBOOK #84-7 DATE DRILLED 12/23/84

TYPE OF PAVEMENT 8" Reinforced

LOCATION REFERENCED TO: Centerline

IDENT NO.	LANE OR RAMP	STATION	LOCATION	MEASUREMENTS PLATE	CORE	MESH DEPTH	DATE POURED
15	W.B.L.	498+26	6' Lt.		7.60	3 1/2"	10-29-84
15A	W.B.L.	498+26	3' Rt.		7.80	3 1/2"	"
15B	W.B.L.	498+46	2' Lt.		8.20	3 1/4"	"
15C	W.B.L.	409+06	3' Lt.		8.30	3 1/2"	"

Remarks:

Check-Out Cores

/S/ State Construction and Materials Engineer

Exhibit 502-D